

Unit 1: AI Reflection, Project Cycle and Ethics

1. AI Reflection

What is Artificial Intelligence?

- Artificial Intelligence (AI) occurs when a machine possesses the ability to mimic human traits.
- An AI machine can make decisions, predict the future, learn, and improve on its own.
- It accomplishes tasks by itself by collecting data, understanding it, analyzing it, learning from it, and improving it.
- To make a machine intelligent, it requires Data combined with an Algorithm.

Applications of AI in Daily Life

- **Face Lock in Smartphones:** The camera captures facial features; whenever they match, the phone unlocks.
- **Smart Assistants:** Siri and Alexa recognize speech patterns to infer meaning and respond.
- **Fraud Detection:** Banking companies use customer profiling and variables to analyze the probability of risk and default.
- **Medical Imaging:** Used to convert 2D scan images into 3D models to help medical professionals understand health conditions.

The Three Domains of AI

- **Computer Vision (CV):** Works with videos and images, enabling machines to interpret and understand visual information.
- **Natural Language Processing (NLP):** Focuses on textual data, enabling machines to comprehend, generate, and manipulate human language.
- **Statistical Data:** Refers to techniques used to analyze, interpret, and draw insights from numerical or tabular data.

AI Domain Games

AI Domain	Game Example	Description
Statistical Data	Rock, Paper and Scissors	The machine learns from the participant's past moves to predict their next move.
NLP	Semantris	A word association game where the AI chooses words most related to the clue you type.
Computer Vision	Quick, Draw	A neural network AI tries to guess what picture or object you are drawing on the screen.

2. AI Project Cycle

Introduction to the Framework

- The AI Project Cycle is the cyclical process followed to complete an AI project.
- It helps create better AI solutions easily, faster, and breaks complex processes into simpler steps.
- The cycle ensures **Efficiency** (faster development) and **Modularity** (breaking problems into smaller parts so you don't have to change everything if one part fails).

The 6 Stages of the AI Project Cycle

- **Problem Scoping:** Setting the goal for the AI project by stating the problem you wish to solve.
- **Data Acquisition:** Collecting accurate and reliable data from various sources to act as the base of the system.
- **Data Exploration:** Visualizing and exploring data to interpret useful information and understand patterns.
- **Modeling:** Selecting and implementing AI algorithms that match the project requirements.
- **Evaluation:** Testing various models to choose the one that gives the most efficient and reliable results.

3. Problem Scoping

The 4Ws Problem Canvas

- **Who:** Identifies the stakeholders (people who face the problem and benefit from the solution) and what you know about them.
- **What:** Determines the nature of the problem and gathers evidence to prove the problem actually exists.
- **Where:** Focuses on the context, situation, and exact location where the problem arises.
- **Why:** Explains the benefits the stakeholders will receive and how the solution improves their situation.

Problem Statement Template

The template summarizes all the key points from the 4Ws canvas into a single, comprehensive paragraph.

Format: Our [Stakeholders] has a problem that [Issue/Problem] when/while [Context/Situation]. An ideal solution would [Benefit to them].

4. Data Acquisition

Understanding Data

- Data is a piece of information, facts, and statistics collected together for reference or analysis.
- **Training Data:** The initial data fed to the machine to train it to predict outputs.
- **Testing Data:** The data set used to test the machine's predictions after it has been trained.
- For efficiency, training data must be authentic and relevant to the scoped problem.

Data Features and Sources

- **Data Features:** The specific types of data parameters or characteristics required to address the issue (e.g., salary amount, increment percentage).
- **Sources of Data:** Surveys, Web Scraping, Sensors, Cameras, Observations, and Application Program Interfaces (APIs).
- **Reliable Sources:** Open-sourced government portals like data.gov.in and india.gov.in are highly reliable and authentic.

System Maps

- System maps help find cause-and-effect relationships between different elements of a scoped problem.
- Elements are connected via arrows; the arrow-head depicts the direction of the effect.
- A **(+) sign** means elements are directly related (if X increases, Y increases).
- A **(-) sign** means elements are inversely related (if X increases, Y decreases).

5. Data Exploration (Data Visualization)

Purpose of Data Exploration

- Raw data is a complex entity full of numbers; exploring it helps make sense of it.
- Visualizing data allows you to quickly get a sense of trends, relationships, and patterns.
- It helps define a strategy for which AI model to use at a later stage.
- It serves as an effective way to communicate data stories to others.

Graphical Tools for Visualization

- **Bar Graphs:** Represents data using vertical and horizontal bars.
- **Line Graphs:** Created by connecting various data points to show the change in quantity over time.
- **Pie Charts:** Circular charts divided into sections proportional to corresponding values.
- **Other Tools:** Scatter Plots and Tree Diagrams.

6. Modeling

AI vs. ML vs. DL

Term	Definition
Artificial Intelligence (AI)	The umbrella term for any technique enabling computers to mimic human intelligence.
Machine Learning (ML)	Enables machines to improve at tasks with experience, learning from new data and past mistakes.
Deep Learning (DL)	A specific subset of ML that trains itself using vast amounts of data and multiple algorithms.

Types of AI Models

- **Rule-Based Approach:** The developer defines the rules and feeds them to the machine alongside the data. The learning is static, meaning it does not adapt to changes made in the original training data.
- **Learning-Based Approach:** The machine learns by itself. It trains on fed data, designs its own model, and adapts to changes to handle exceptions.

7. Evaluation

The Purpose of Evaluation

- Evaluation is testing the model with Testing Data to calculate its efficiency and performance.
- It checks if the model is correctly solving the identified AI problem.

Evaluation Terminologies (The Confusion Matrix)

- **True Positive (TP):** The machine's prediction is True (Yes), and the reality matches it (Yes).
- **True Negative (TN):** The machine's prediction is False (No), and the reality matches it (No).
- **False Positive (FP):** The machine's prediction is True (Yes), but the reality does not match (No).
- **False Negative (FN):** The machine's prediction is False (No), but the reality does not match (Yes).

8. Deployment

What is Deployment?

- Deployment is the final stage where the AI model is implemented in a real-world scenario so it is ready to be used.
- AI solutions can be deployed on Mobile Applications, Website Applications, and self-service kiosks.

Case Study: Preventable Blindness

- **Problem:** Diabetes causes Diabetic Retinopathy, leading to blindness; a lack of doctors causes delays in reports.
- **Solution Deployment:** Aravind Eye Hospital partnered with Google to deploy an AI screening solution.
- **Result:** Technicians take eye pictures, and the AI analyzes them with 98.6% accuracy, allowing for early and quick detection in rural areas.

9. AI Ethics

Ethics vs. Morals

Category	Definition	Characteristics
Morals	Beliefs dictated by our society, culture, or tradition.	Not fixed; can differ across different societies (e.g., always speak the truth).
Ethics	Guiding principles chosen by a person to decide what is good or bad.	Personal values used to navigate complex situations (e.g., is it good to speak the truth if it causes harm?).

Ethical Issues and AI Principles

- **Data Privacy:** AI models must keep individual data safe, obtain user consent, inform users how data is used, and never compromise safety.
- **AI Bias:** Bias occurs when training data favors one group over another. AI must accurately represent all populations and not discriminate against specific groups.
- **Human Rights:** AI development must protect human freedom and ensure it does not unfairly deprive people of jobs.
- **Inclusion:** AI must be easy to use for everyone and benefit all socioeconomic classes equally without excluding any specific group.